

REMARKS

Claims 2-7 stand rejected under 35 U.S.C. § 112, second paragraph (with corresponding objections to the claims and specification). It is respectfully submitted that the enclosed amendment obviates this rejection and the corresponding objections to the claims and specification.

Claims 2-3 and 6-7 stand rejected under 35 U.S.C. § 102 as being anticipated by Ogura '282. Claims 2 and 6 are independent. In order to expedite issuance of this application, claims 2, 3, 6 and 7 have been canceled without prejudice/disclaimer to the subject matter embodied thereby, rendering this rejection moot.

Claims 4 and 5 stand rejected under 35 U.S.C. § 103 as being unpatentable over Ogura '282 in view of Ogura '552. This rejection is respectfully traversed for the following reasons.

Claim 4 recites in pertinent part, "the band gap in the collector layer being larger than the band gap in the emitter layer." One exemplary embodiment of this feature is described, for example, on page 30, lines 2-5 of Applicants' specification corresponding to Figure 4 of Applicants' drawings, whereby a p-type $\text{Al}_{0.3}\text{Ga}_{0.7}\text{As}$ is used for the emitter layer 305 and a p-type $\text{Al}_{0.4}\text{Ga}_{0.6}\text{As}$ containing aluminium in a larger proportion than in the emitter layer 305 is used for the collector layer 302. In this regard, as would be recognized by one of ordinary skill in the art, band gap becomes larger as the amount of Al increases.

In direct contrast, Ogura '282 discloses that *both* collector layer 16 and emitter layer 12 are composed of $\text{Al}_{0.4}\text{Ga}_{0.6}\text{As}$ (*see* col. 10, lines 47-50). As a result, the layers 12 and 16 will have the same spike size, from which there is no suggestion on how to effectively suppress the leakage of holes or electrons into the collector layer. In any event, Ogura '282 does not disclose

or suggest the band gap in the collector layer being larger than the band gap in the emitter layer. Ogura '552, on the other hand, does not obviate the aforementioned deficiency of Ogura '282. Indeed, Ogura '552 appears silent as to the composition of each layer, let alone suggest the band gap in the collector layer being larger than the band gap in the emitter layer.

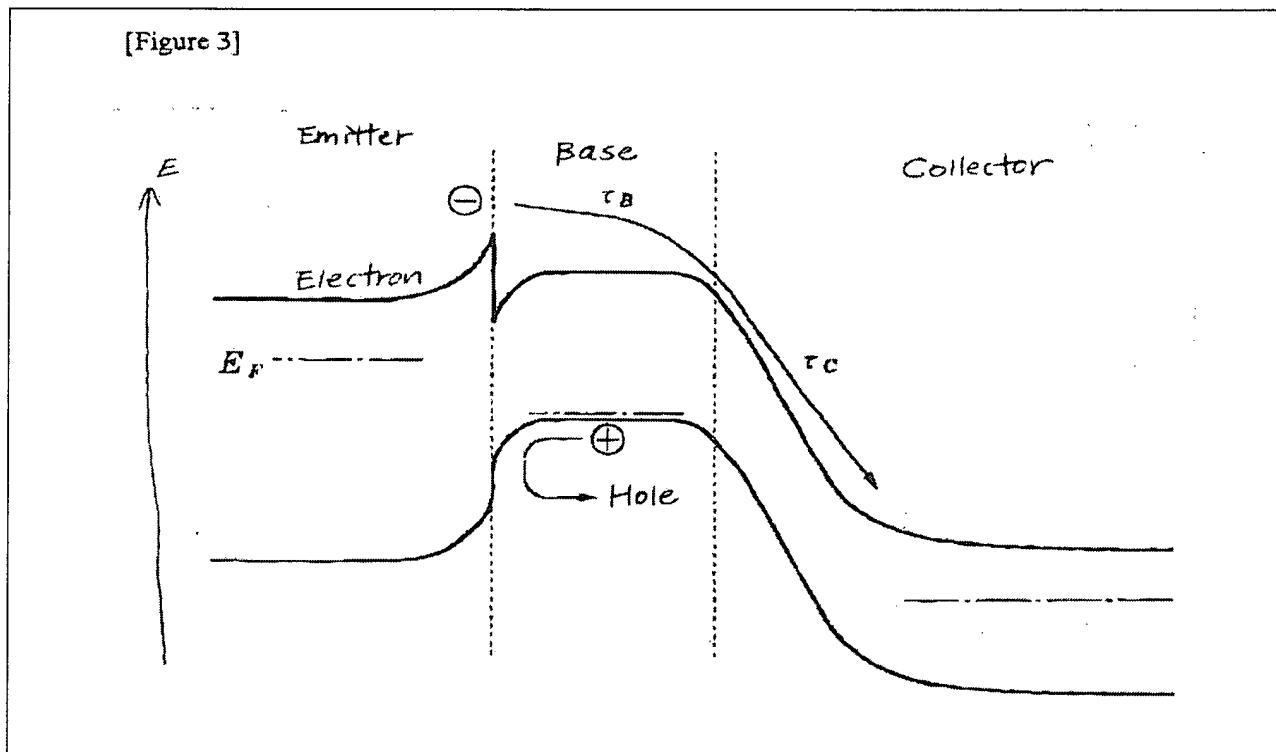
In view of the foregoing, it is respectfully submitted that neither Ogura '282 nor Ogura '552, alone or in combination, disclose or suggest the claimed combination of elements. The Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard for establishing obviousness under § 103:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

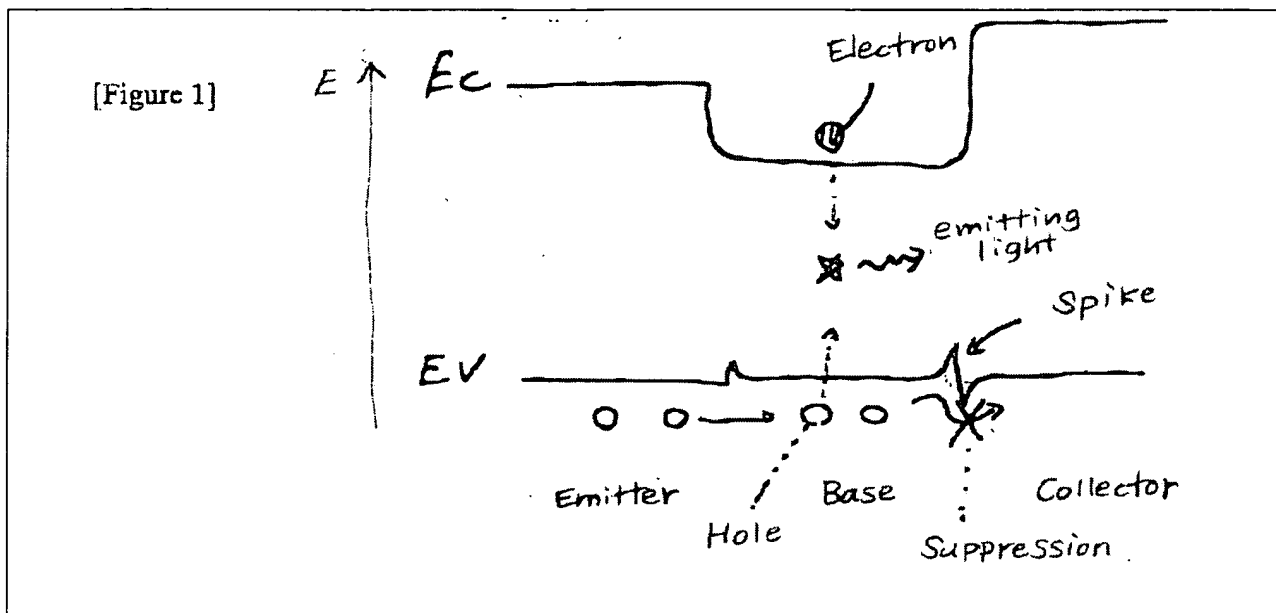
In the instant case, the pending rejection does not "establish *prima facie* obviousness of [the] claimed invention" as recited in claim 4 because the proposed combination fails the "all the claim limitations" standard required under § 103.

Indeed, it is respectfully submitted that a Group III-V compound semiconductor bipolar transistor of a switching device conventionally includes an emitter layer having a band gap larger than or equal to the collector layer. Exhibitory Figure 3 below shows a band profile of a conventional npn-type Hetero Bipolar Transistor (HBT), in which high gain is achieved by reducing hole current flowing from the base layer to the emitter layer; whereby a band gap in the emitter layer is made larger than in the base layer. In addition, to shorten the time for electrons to transfer from the emitter layer, through the base region, and to the collector region, the conventional design is such that a band gap of the collector layer is equal to or smaller than that of the base layer. It follows that the conventional Group III-V compound semiconductor bipolar

transistor does not include a collector layer whose band gap is larger than that of the emitter layer, and only Applicants have conceived of a novel combination of elements whereby the band gap in the collector layer is larger than the band gap in the emitter layer.

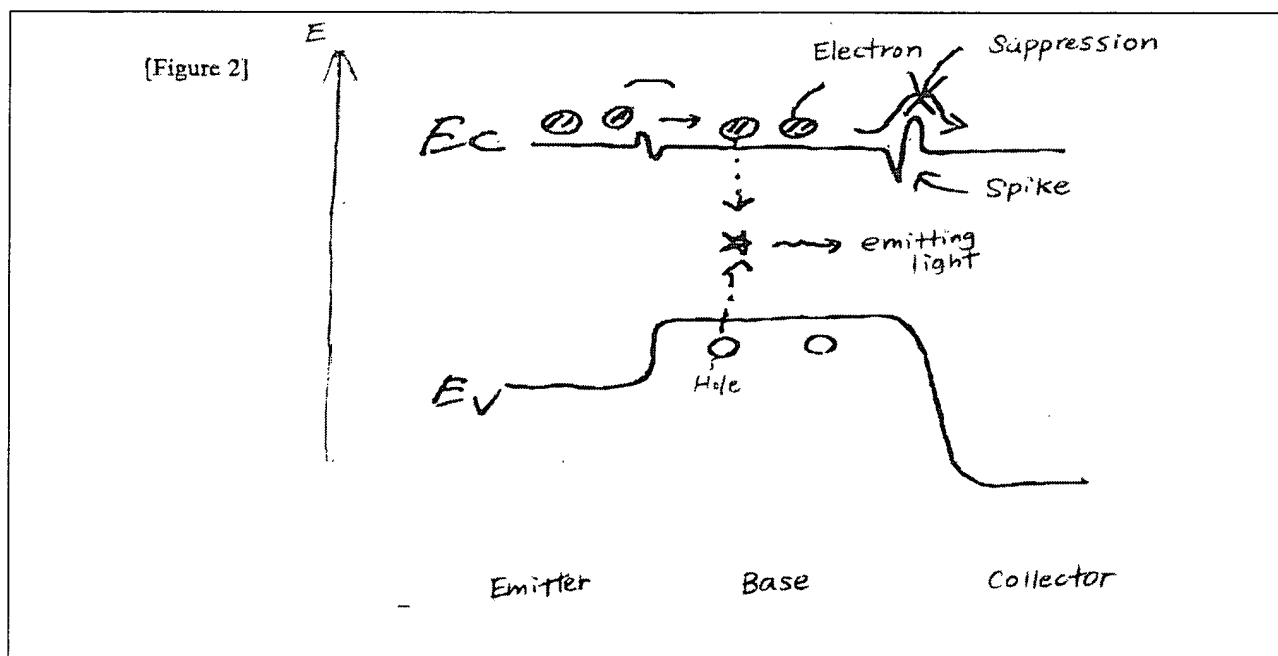


According to one aspect of the present invention as recited in claim 4, in view of the *combination* of elements recited therein, leakage to the collector layer of the holes that have transferred from the emitter layer to the base layer can be suppressed during ON time, as shown in exhibitory Figure 1 below.



Specifically, according to one aspect of the present invention, when the device is turned ON, the spike at the valence band between the base layer and the collector layer 302 can become larger than the spike at the valence band between the base layer and the emitter layer. The large spike can prevent leakage of holes into the collector layer that have transferred from the emitter layer to the base layer 304 when the device is turned ON; and the holes can smash into electrons in the base layer, which emits light.

Similarly with an npn-type semiconductor light-emitting device, the spike at the conduction band between the base layer and the collector layer can become larger than the spike at the conduction band between the base layer and the emitter layer so as to enable prevention of electron leakage into the collector layer that have transferred from the emitter layer to the base layer (see exhibitory Figure 2 below).



Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claim 4 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Based on the foregoing, it is respectfully submitted that all pending claims are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejection under 35 U.S.C. § 103 be withdrawn.

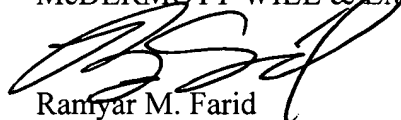
CONCLUSION

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication for which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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